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(54) **SPEECH ANALYTICS: CONVERSATION TIMING AND ADJUSTMENT**

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H04M 3/523	(2006.01)
H04M 3/22	(2006.01)
H04M 3/42	(2006.01)

(52) **U.S. Cl.**

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(58) **Field of Classification Search**

None

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,204,884	B2	6/2012	Freedman et al.
9,258,421	B2	2/2016	Matula et al.
2008/0049795	A1	2/2008	Lakaneimi
2008/0240374	A1	10/2008	Conway et al.
2010/0235218	A1	9/2010	Erhart et al.
2010/0296417	A1	11/2010	Steiner
2011/0125793	A1	5/2011	Erhart et al.
2011/0125826	A1	5/2011	Erhart et al.
2011/0255683	A1	10/2011	Flockhart et al.
2015/0195406	A1	7/2015	Dwyer et al.

OTHER PUBLICATIONS

Official Action for U.S. Appl. No. 14/268,966, mailed Apr. 9, 2015 5 pages.

Official Action for U.S. Appl. No. 14/268,966, mailed May 13, 2015 7 pages.

Notice of Allowance for U.S. Appl. No. 14/268,966, mailed Oct. 15, 2015 11 pages.

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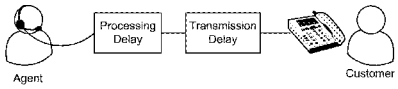
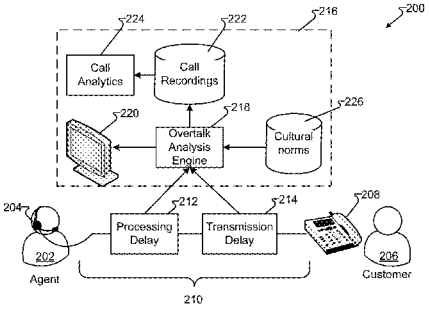
(57) **ABSTRACT**

Agents of a contact center often encounter conversational delays when speaking with a customer. These delays may be introduced by transmission delays, which include the distance between the agent and the customer, and processing delays, such as those introduced by systems and processes within a contact center. By providing an agent with information based on the amount of the delay, the agent can be prompted to overtalk the customer by a target amount. As a result, the customer may experience a more natural conversation with the agent. Furthermore, if a customer prefers more or less of a delay, such as based on their cultural norms, the delay may be modified to account for those cultural norms and better accommodate the conversational preferences of a diverse customer base.

21 Claims, 6 Drawing Sheets





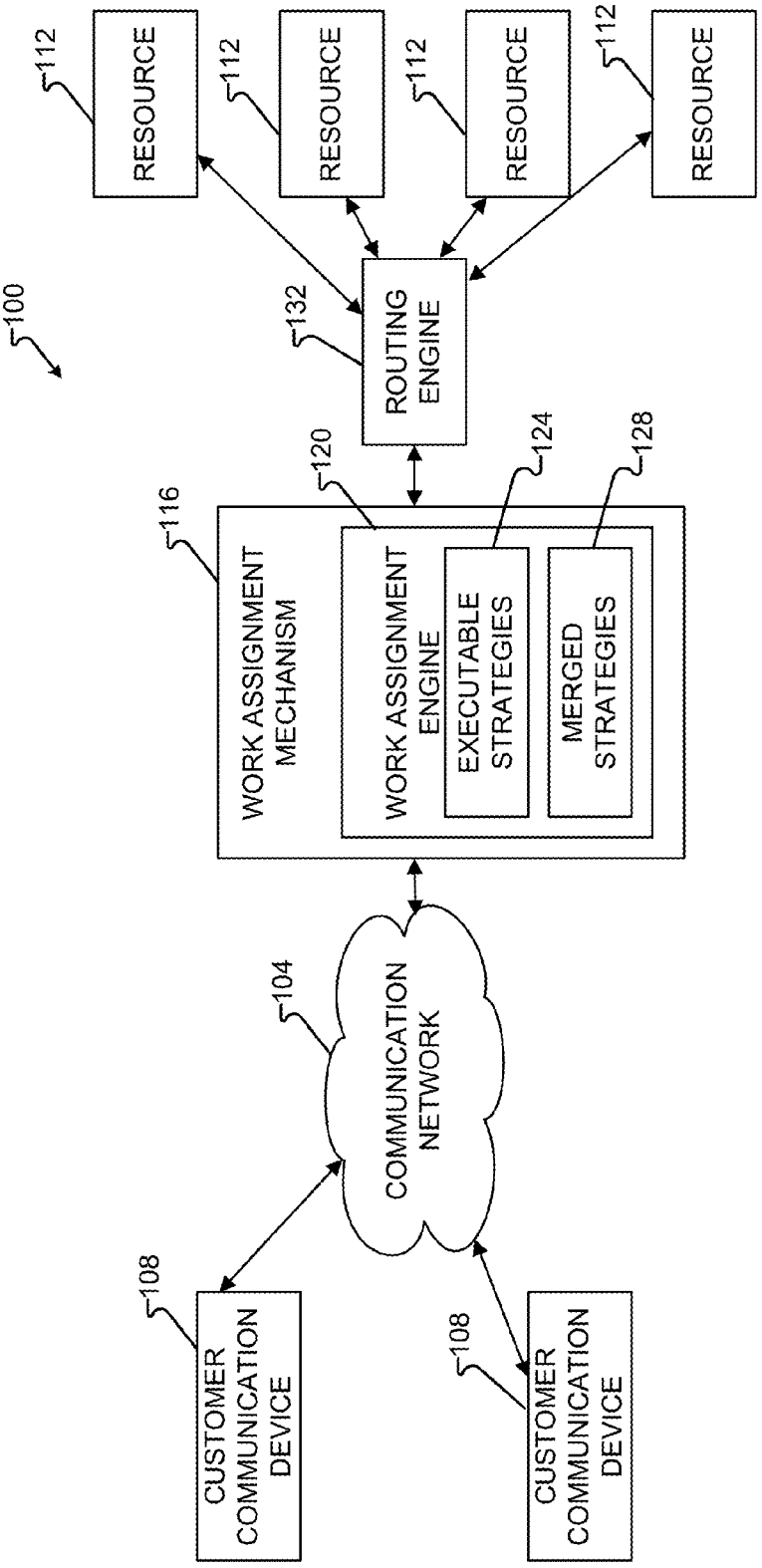
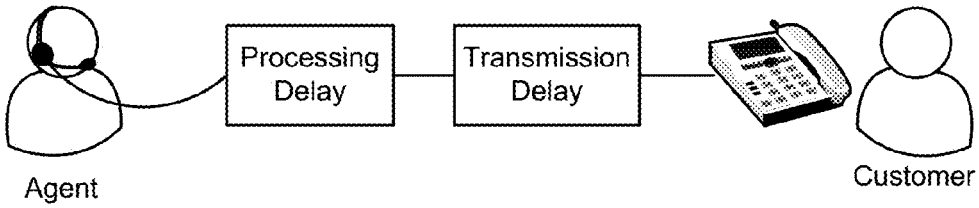

100
112
RESOURCE
112
RESOURCE
112
RESOURCE
112
RESOURCE
132
ROUTING ENGINE
120
124
128
116
WORK ASSIGNMENT MECHANISM
WORK ASSIGNMENT ENGINE
EXECUTABLE STRATEGIES
MERGED STRATEGIES
104
COMMUNICATION NETWORK
108
CUSTOMER COMMUNICATION DEVICE
108
CUSTOMER COMMUNICATION DEVICE

FIG. 1


Processing Delay
Transmission Delay
Agent
Customer

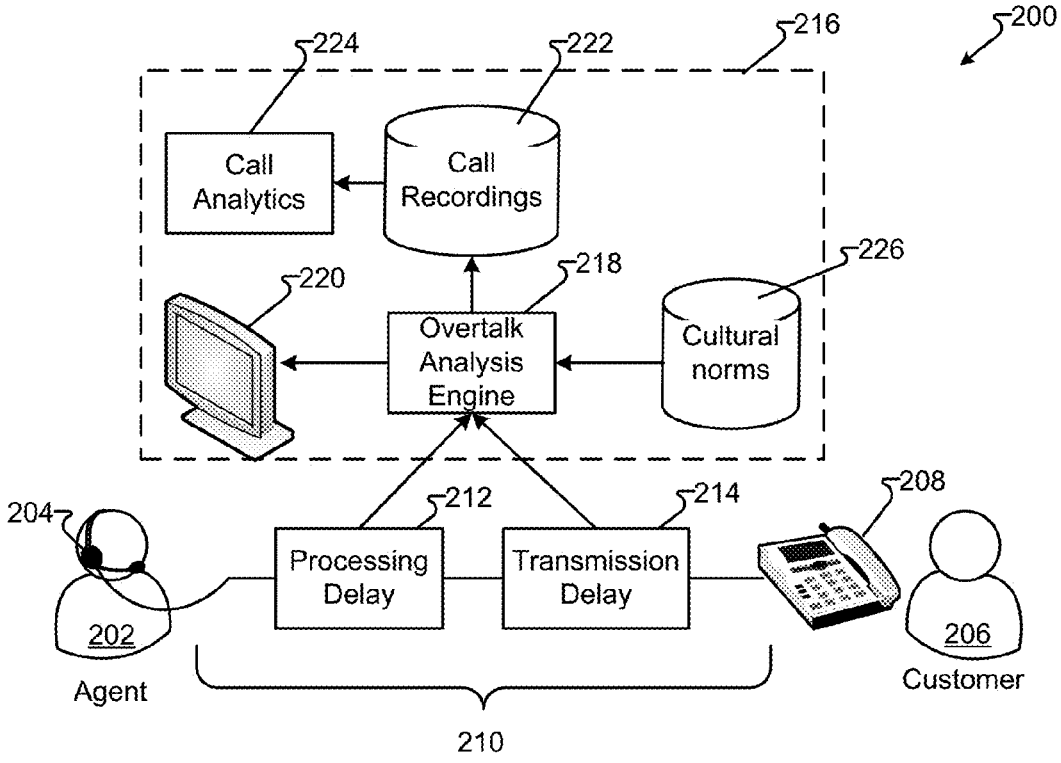

200
216
224
222
Call Analytics
Call Recordings
218
220
226
Overtalk Analysis Engine
Cultural norms
204
212
214
208
Processing Delay
Transmission Delay
202
206
Agent
Customer
210

FIG. 2

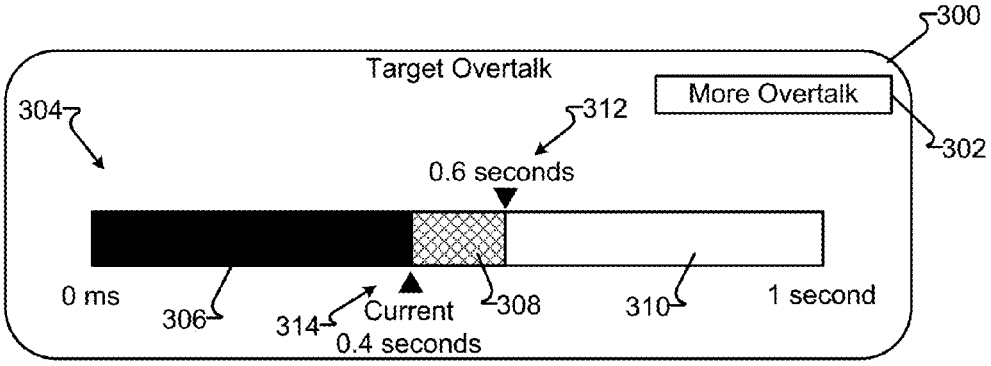

300
Target Overtalk
More Overtalk
304
312
302
0.6 seconds
0 ms
306
314
Current
0.4 seconds
308
310
1 second

FIG. 3

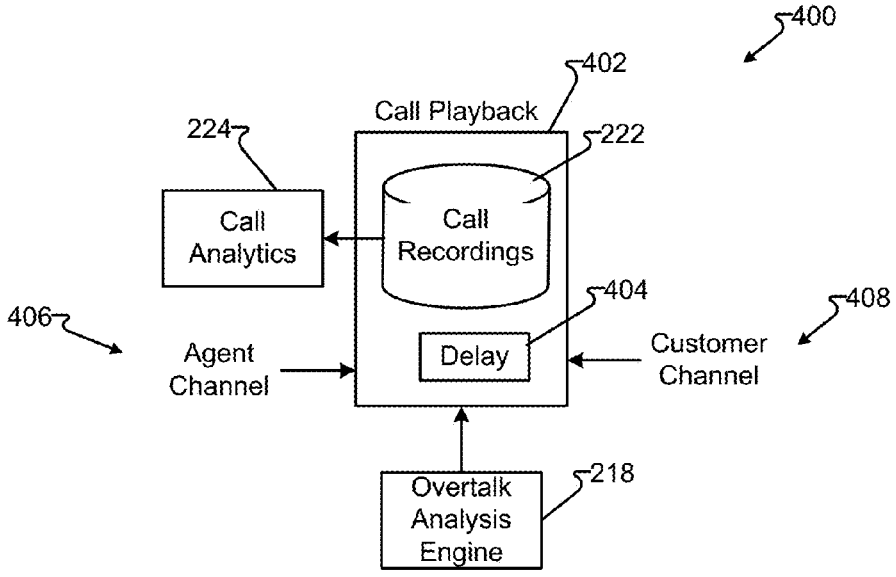

400
402
Call Playback
224
222
Call Analytics
Call Recordings
404
406
408
Agent Channel
Delay
Customer Channel
218
Overtalk Analysis Engine

FIG. 4

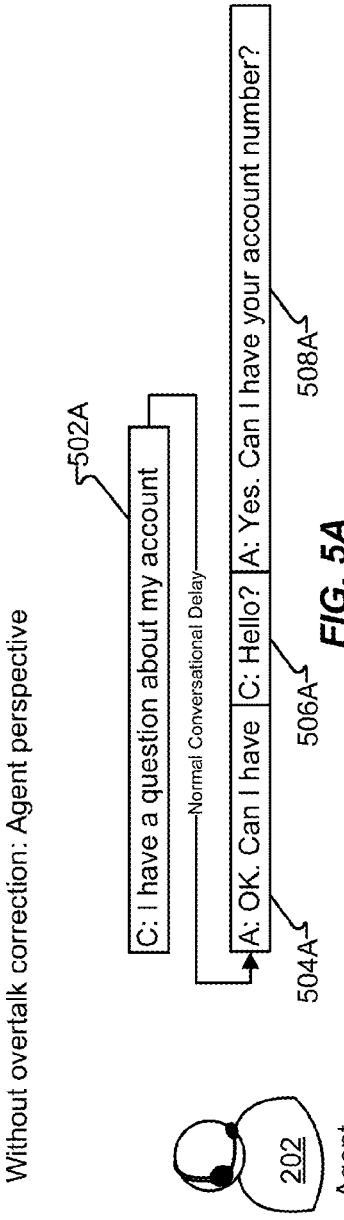

Without overtalk correction: Agent perspective
502A
C: I have a question about my account
Normal Conversational Delay
A: OK. Can I have
C: Hello?
A: Yes. Can I have your account number?
504A
506A
508A
202
Agent

FIG. 5A

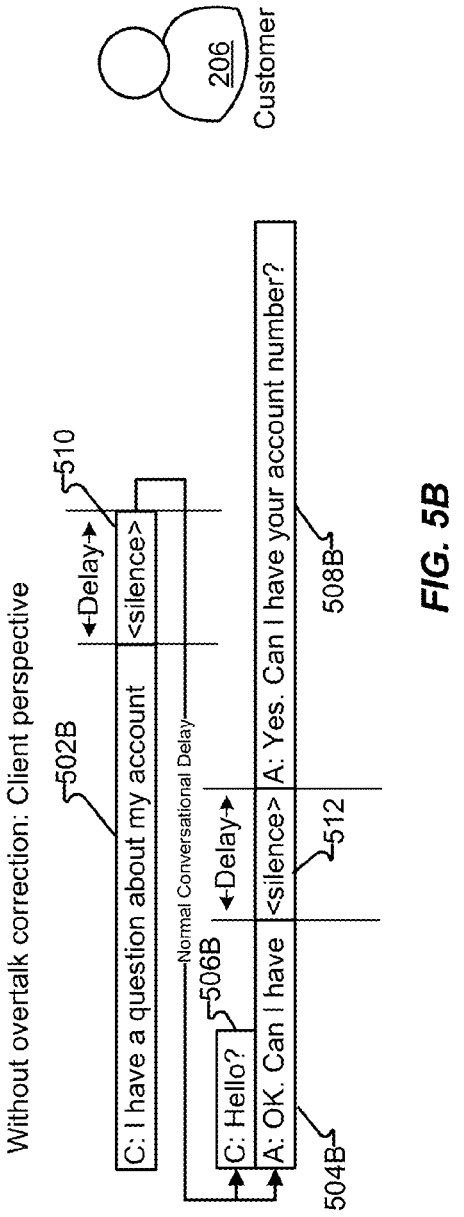

Without overtalk correction: Client perspective
502B
510
Delay
<silence>
C: I have a question about my account
Normal Conversational Delay
506B
Delay
C: Hello?
A: OK. Can I have
<silence>
512
A: Yes. Can I have your account number?
504B
508B
206
Customer

FIG. 5B

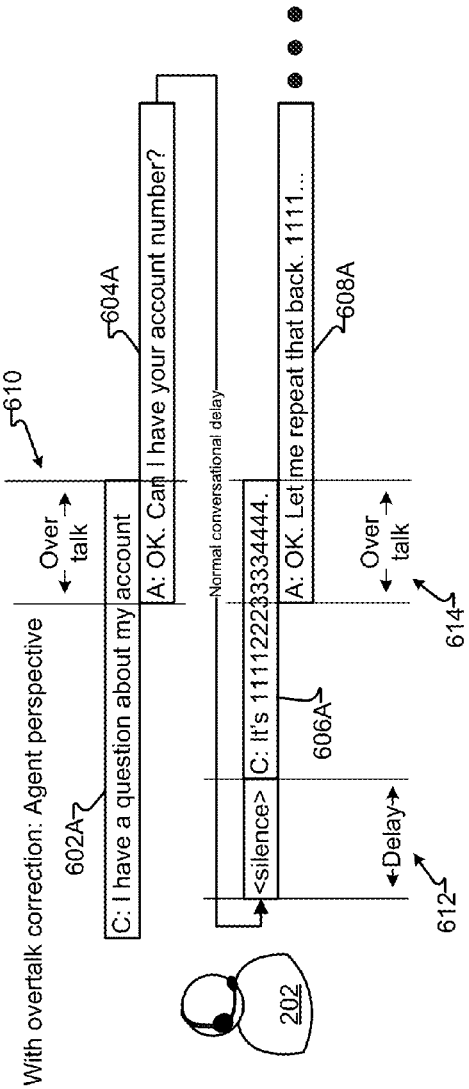

With overtalk correction: Agent perspective
610
602A
C: I have a question about my account
Over talk
604A
A: OK. Can I have your account number?
Normal conversational delay
<silence>
C: it's 111122233334444.
606A
A: OK. Let me repeat that back. 1111...
608A
Delay
612
Over talk
614
202

FIG. 6A

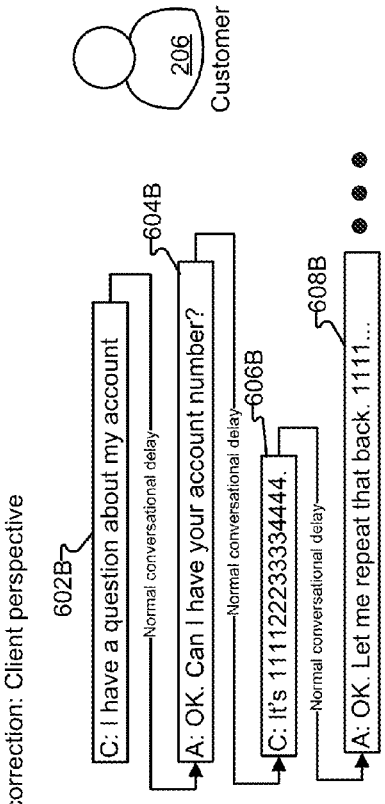

With overtalk correction: Client perspective
602B
C: I have a question about my account
Normal conversational delay
604B
A: OK. Can I have your account number?
Normal conversational delay
606B
C: it's 111122233334444.
Normal conversational delay
608B
A: OK. Let me repeat that back. 1111...
206
Customer

FIG. 6B

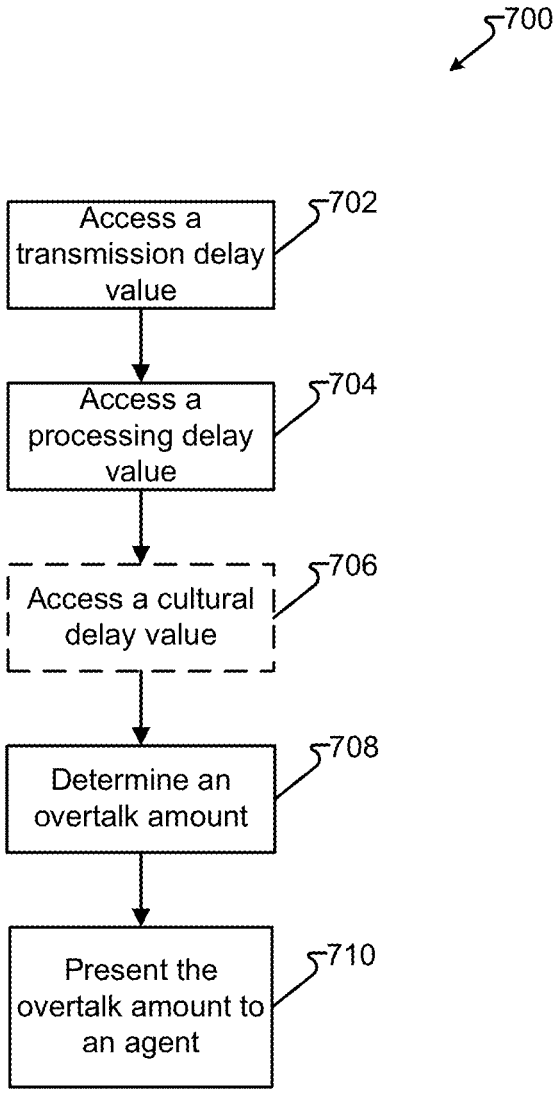

700
Access a transmission delay value
702
Access a processing delay value
704
Access a cultural delay value
706
Determine an overtalk amount
708
Present the overtalk amount to an agent
710

FIG. 7

SPEECH ANALYTICS: CONVERSATION TIMING AND ADJUSTMENT

CROSS REFERENCE TO RELATED APPLICATION

The present application is a continuation of U.S. patent application Ser. No. 14/268,966, filed May 2, 2014, entitled "SPEECH ANALYTICS: CONVERSATION TIMING AND ADJUSTMENT", which is incorporated herein by this reference in its entirety.

FIELD OF THE DISCLOSURE

The present disclosure is generally directed toward speech analytics and specifically toward speech analytics within a contact center environment.

BACKGROUND

Spoken communication between individuals is a fundamental aspect of human nature. Delays, pauses, interruptions, overtalking, etc. may convey, intentionally or unintentionally, a meaning beyond the words themselves. One significant problem with calls, especially cell phone, voice over IP, or voice/video conference calls, is that there can be serious transmission and codec encoding/decoding delays, which substantially affect interactions. There are also cultural aspects to conversations that should be considered. For example, a longer pause in Japanese might be indicative of respect. The manner in which people interact and factors that impact conversation are large concerns for contact centers.

Anyone that has made a call between two cell phones in the same room has likely experienced this large delay firsthand—speaking into one phone, the voice is reproduced on the second handset over a second later.

On the other hand, the delay on a landline PSTN link or VoIP equivalent can be quite low. A G.711 codec has negligible delay other than the frame and packetization delay of 10 or 20 ms. Transmission may add 60-80 ms, and so the end to end delay will typically be under 150 ms.

A customer's perception of the agent and/or the company may be adversely affected based on the conversation delay being inappropriate. On the other hand, a customer may be well-aware of the delay and may think a contact center agent is quite responsive and helpful; however, a post hoc analysis of a highly-delayed call may result in the contact center agent being given a poor grade even though the agent was doing everything within their power to provide the appropriate amount of customer service.

SUMMARY

It is with respect to the above issues and other problems that the embodiments presented herein were contemplated. Certain embodiments disclosed estimate the delay experienced in a customer/client side of a conversation and provides means to account and compensate for the delay. Other embodiments include conversation analytics that account for delay in assessing a contact center agent's performance.

For communications with high delay, the agent might be perceived as being "attentive" if they begin speaking as they hear the customer complete a sentence—because the agent is hearing the customer after significant delay, and the path from the agent to the customer will add more delay. If the agent speaks before they hear the customer's last bit of speech, the customer may then perceive the conversation as proceeding in a normal pace.

On the other hand, if the agent then does the same "overtalk response" to a customer on a low delay circuit, the agent will be speaking over the customer, and the customer will likely perceive this as the agent being pushy, rude, or not caring about the customer's statement.

Furthermore, even if the agent correctly anticipates the delay for every call, one must remember that the call is likely recorded for quality monitoring purposes. On playback, it will appear that for some calls, the agent is impolite and overtalking the customer, but polite on other calls. If the agent is not coached, then on low delay calls the customer will appear to be happy, while on high delay calls the customer may be displeased or even complain with statements, such as, "are you listening" or "pay attention" due to long pauses between interactions—especially if the pause is a combination of transmission delays and delays in the agent understanding a statement, interacting with a computer screen, etc.

A system is disclosed that may coach the agent on how best to talk with the detected summation of delays. The estimated delay on the client side would be added to measured network, codec, and other delays as an aggregate number to give an agent an estimate of how quickly to respond or how much overtalk should be employed to effectively balance the conversation based on conversation analytics. Similarly, automated agents, such as interactive voice response ("IVR") systems may similarly be given an overtalk amount in order to facilitate a more appropriate delay as observed by the customer. In certain other embodiments, a transmission delay is inserted by the recording equipment, which is often co-located with the agent or otherwise records substantially the agent's perspective of the call, into the recorded call such that that recording better reflects the customer's experience with the call. Subsequent conversational analysis processes may then properly take into account the end-to-end delay and its effect on the perceived experience of the customer when analyzing the conversation.

Conversational Analysis ("CA") is a method commonly used to study both verbal and non-verbal interactions, covering both casual conversations and task-oriented exchanges. CA examines the social organization of conversations, typically through the use of recordings and transcriptions. CA typically employs sampling techniques and coding procedures, testing, and statistics. CA is designed to provide a specific kind of insight into the way people interact.

In today's telephony systems, especially when the media includes video, delays range from small and imperceptible to big and call impacting. Transmission delays may be measured/estimated using ping or traceroute. Processing delays, such as for codecs can also be factored in (e.g., G.729, 10-15 ms; G.711, 125 ms; Facetime, 40-50 ms delay).

Common delay specifications may include (in milliseconds):

0-150: Acceptable for most user applications;

150-400: Acceptable provided that administrators are aware of the transmission time and the impact it has on the transmission quality of user applications; and

Above 400: Unacceptable for general network planning purposes.

A customer may sit on a call to a contact center with significant delay for 0.5 to 0.75 seconds. During this time,

the customer may be wondering if an agent is still listening, if the call is still up, etc. The delay may cause overlap, customer dissatisfaction, abandonment, and other woes. Overlap is where an agent and a customer either speak at the same time or both wait for the other to speak, both of which are undesirable in the contact center.

Certain embodiments described provide for a system that is able to provide feedback on the delay to an analyzer using a data channel. The data channel may be used to detect when someone is talking and/or done talking. The CA would be run from the perspective of the customer, rather than the agent. The aggregated information could be used to coach an analytics system, an automated system, or an agent to adjust a conversation based on the delay.

A display may be provided to the agent to provide suggestions for overtalk and/or adjustments for talking to the customer to sound appropriately responsive.

In one embodiment, a method is disclosed, comprising: accessing a transmission delay value of a communications system, the transmission delay value indicating the transmission delay of at least a voice portion of an intended conversation between an agent and a customer; accessing a processing delay value of the communications system, the processing delay value indicating the processing delay of at least a voice portion of the intended conversation; calculating an overtalk amount as the sum of the transmission delay value and the processing delay value; and providing an indicator of the overtalk amount, at least one of, the agent and a call analytics engine.

In other embodiment, a system is disclosed, comprising: a processor; an agent device; an agent display; a network interface operable to facilitate communication between the agent device and a customer device; and wherein the processor is operable to: access a transmission delay value of a communications system, the transmission delay value indicating the transmission delay of at least a voice portion of an intended conversation between an agent and a customer; access a processing delay value of the communications system, the processing delay value indicating the processing delay of at least a voice portion of the intended conversation; calculate an overtalk amount as the sum of the transmission delay value and the processing delay value; and cause an indicator of the overtalk amount to be provided to, at least one of, the agent and a call analytics engine.

In yet another embodiment, a non-transitory computer readable medium is disclosed with instructions thereon that when read by the computer cause the computer to perform: accessing a transmission delay value of a communications system, the transmission delay value indicating the transmission delay of at least a voice portion of an intended conversation between an agent and a customer; accessing a processing delay value of the communications system, the processing delay value indicating the processing delay of at least a voice portion of the intended conversation; calculating an overtalk amount as the sum of the transmission delay value and the processing delay value; and providing an indicator of the overtalk amount, at least one of, the agent and a call analytics engine.

The phrases "at least one," "one or more," and "and/or" are open-ended expressions that are both conjunctive and disjunctive in operation. For example, each of the expressions "at least one of A, B and C," "at least one of A, B, or C," "one or more of A, B, and C," "one or more of A, B, or C" and "A, B, and/or C" means A alone, B alone, C alone, A and B together, A and C together, B and C together, or A, B and C together.

The term "a" or "an" entity refers to one or more of that entity. As such, the terms "a" (or "an"), "one or more" and "at least one" can be used interchangeably herein. It is also to be noted that the terms "comprising," "including," and "having" can be used interchangeably.

The term "automatic" and variations thereof, as used herein, refers to any process or operation done without material human input when the process or operation is performed. However, a process or operation can be automatic, even though performance of the process or operation uses material or immaterial human input, if the input is received before performance of the process or operation. Human input is deemed to be material if such input influences how the process or operation will be performed. Human input that consents to the performance of the process or operation is not deemed to be "material."

The term "computer-readable medium" as used herein refers to any tangible storage that participates in providing instructions to a processor for execution. Such a medium may take many forms, including but not limited to, non-volatile media, volatile media, and transmission media. Non-volatile media includes, for example, NVRAM, or magnetic or optical disks. Volatile media includes dynamic memory, such as main memory. Common forms of computer-readable media include, for example, a floppy disk, a flexible disk, hard disk, magnetic tape, or any other magnetic medium, magneto-optical medium, a CD-ROM, any other optical medium, punch cards, paper tape, any other physical medium with patterns of holes, a RAM, a PROM, and EPROM, a FLASH-EPROM, a solid state medium like a memory card, any other memory chip or cartridge, or any other medium from which a computer can read. When the computer-readable media is configured as a database, it is to be understood that the database may be any type of database, such as relational, hierarchical, object-oriented, and/or the like. Accordingly, the disclosure is considered to include a tangible storage medium and prior art-recognized equivalents and successor media, in which the software implementations of the present disclosure are stored.

The terms "determine," "calculate," and "compute," and variations thereof, as used herein, are used interchangeably and include any type of methodology, process, mathematical operation or technique.

The term "module" as used herein refers to any known or later developed hardware, software, firmware, artificial intelligence, fuzzy logic, or combination of hardware and software that is capable of performing the functionality associated with that element. Also, while the disclosure is described in terms of exemplary embodiments, it should be appreciated that other aspects of the disclosure can be separately claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

The present disclosure is described in conjunction with the appended figures:

FIG. **1** depicts a communication system in accordance with embodiments of the present disclosure;

FIG. **2** depicts a communication system in accordance with at least some embodiments of the present disclosure;

FIG. **3** depicts a dialog window in accordance with at least some embodiments of the present disclosure;

FIG. **4** depicts a call analysis system in accordance with at least some embodiments of the present disclosure;

FIGS. **5**A and **5**B depict one conversation segment between an agent and a customer without overtalk correction;

FIGS. **6**A and **6**B depicts a second conversation segment between an agent and a customer using overtalk correction in accordance with at least some embodiments of the present disclosure; and

FIG. **7** depicts a process in accordance with at least some embodiments of the present disclosure.

DETAILED DESCRIPTION

The ensuing description provides embodiments only, and is not intended to limit the scope, applicability, or configuration of the claims. Rather, the ensuing description will provide those skilled in the art with an enabling description for implementing the embodiments. It being understood that various changes may be made in the function and arrangement of elements without departing from the spirit and scope of the appended claims.

The identification in the description of element numbers without a subelement identifier, when a subelement identifiers exist in the figures, when used in the plural, is intended to reference any two or more elements with a like element number. A similar usage in the singular, is intended to reference any one of the elements with the like element number. Any explicit usage to the contrary or further qualification shall take precedence.

The exemplary systems and methods of this disclosure will also be described in relation to analysis software, modules, and associated analysis hardware. However, to avoid unnecessarily obscuring the present disclosure, the following description omits well-known structures, components and devices that may be shown in block diagram form, and are well known, or are otherwise summarized.

For purposes of explanation, numerous details are set forth in order to provide a thorough understanding of the present disclosure. It should be appreciated, however, that the present disclosure may be practiced in a variety of ways beyond the specific details set forth herein.

FIG. **1** shows an illustrative embodiment of communication system **100** in accordance with at least some embodiments of the present disclosure. The communication system **100** may be a distributed system and, in some embodiments, comprises a communication network **104** connecting one or more communication devices **108** to a work assignment mechanism **116**, which may be owned and operated by an enterprise administering a contact center in which a plurality of resources **112** are distributed to handle incoming work items (in the form of contacts) from customer communication devices **108**.

In accordance with at least some embodiments of the present disclosure, the communication network **104** may comprise any type of known communication medium or collection of communication media and may use any type of protocols to transport messages between endpoints. The communication network **104** may include wired and/or wireless communication technologies. The Internet is an example of the communication network **104** that constitutes an Internet Protocol (IP) network consisting of many computers, computing networks, and other communication devices located all over the world, which are connected through many telephone systems and other means. Other examples of the communication network **104** include, without limitation, a standard Plain Old Telephone System (POTS), an Integrated Services Digital Network (ISDN), the Public Switched Telephone Network (PSTN), a Local Area Network (LAN), a Wide Area Network (WAN), a Session Initiation Protocol (SIP) network, a Voice over IP (VoIP) network, a cellular network, and any other type of packet-switched or circuit-switched network known in the art. In addition, it can be appreciated that the communication network **104** need not be limited to any one network type, and instead may be comprised of a number of different networks and/or network types. As one example, embodiments of the present disclosure may be utilized to increase the efficiency of a grid-based contact center. Examples of a grid-based contact center are more fully described in U.S. patent application Ser. No. 12/469,523 to Steiner, the entire contents of which are hereby incorporated herein by reference. Moreover, the communication network **104** may comprise a number of different communication media such as coaxial cable, copper cable/wire, fiber-optic cable, antennas for transmitting/receiving wireless messages, and combinations thereof.

The communication devices **108** may correspond to customer communication devices. In accordance with at least some embodiments of the present disclosure, a customer may utilize their communication device **108** to initiate a work item, which is generally a request for a processing resource **112**. Illustrative work items include, but are not limited to, a contact directed toward and received at a contact center, a web page request directed toward and received at a server farm (e.g., collection of servers), a media request, an application request (e.g., a request for application resources location on a remote application server, such as a SIP application server), and the like. The work item may be in the form of a message or collection of messages transmitted over the communication network **104**. For example, the work item may be transmitted as a telephone call, a packet or collection of packets (e.g., IP packets transmitted over an IP network), an email message, an Instant Message, an SMS message, a fax, and combinations thereof. In some embodiments, the communication may not necessarily be directed at the work assignment mechanism **116**, but rather may be on some other server in the communication network **104** where it is harvested by the work assignment mechanism **116**, which generates a work item for the harvested communication. An example of such a harvested communication includes a social media communication that is harvested by the work assignment mechanism **116** from a social media network or server. Exemplary architectures for harvesting social media communications and generating work items based thereon are described in U.S. patent application Ser. Nos. 12/784,369, 12/706,942, and 12/707,277, filed Mar. 20, 1010, Feb. 17, 2010, and Feb. 17, 2010, respectively, each of which are hereby incorporated herein by reference in their entirety.

The format of the work item may depend upon the capabilities of the communication device **108** and the format of the communication. In particular, work items are logical representations within a contact center of work to be performed in connection with servicing a communication received at the contact center (and more specifically the work assignment mechanism **116**). The communication may be received and maintained at the work assignment mechanism **116**, a switch or server connected to the work assignment mechanism **116**, or the like until a resource **112** is assigned to the work item representing that communication at which point the work assignment mechanism **116** passes the work item to a routing engine **132** to connect the communication device **108** which initiated the communication with the assigned resource **112**.

Although the routing engine **132** is depicted as being separate from the work assignment mechanism **116**, the routing engine **132** may be incorporated into the work

assignment mechanism **116** or its functionality may be executed by the work assignment engine **120**.

In accordance with at least some embodiments of the present disclosure, the communication devices **108** may comprise any type of known communication equipment or collection of communication equipment. Examples of a suitable communication device **108** include, but are not limited to, a personal computer, laptop, Personal Digital Assistant (PDA), cellular phone, smart phone, telephone, or combinations thereof. In general each communication device **108** may be adapted to support video, audio, text, and/or data communications with other communication devices **108** as well as the processing resources **112**. The type of medium used by the communication device **108** to communicate with other communication devices **108** or processing resources **112** may depend upon the communication applications available on the communication device **108**.

In accordance with at least some embodiments of the present disclosure, the work item is sent toward a collection of processing resources **112** via the combined efforts of the work assignment mechanism **116** and routing engine **132**. The resources **112** can either be completely automated resources (e.g., Interactive Voice Response (IVR) units, processors, servers, or the like), human resources utilizing communication devices (e.g., human agents utilizing a computer, telephone, laptop, etc.), or any other resource known to be used in contact centers.

As discussed above, the work assignment mechanism **116** and resources **112** may be owned and operated by a common entity in a contact center format. In some embodiments, the work assignment mechanism **116** may be administered by multiple enterprises, each of which has their own dedicated resources **112** connected to the work assignment mechanism **116**.

In some embodiments, the work assignment mechanism **116** comprises a work assignment engine **120** which enables the work assignment mechanism **116** to make intelligent routing decisions for work items. In some embodiments, the work assignment engine **120** is configured to administer and make work assignment decisions in a queueless contact center, as is described in U.S. patent application Ser. No. 12/882,950, the entire contents of which are hereby incorporated herein by reference. In other embodiments, the work assignment engine **120** may be configured to execute work assignment decisions in a traditional queue-based (or skill-based) contact center.

More specifically, the work assignment engine **120** comprises executable strategies **124** that, when executed, enable the work assignment engine **120** to determine which of the plurality of processing resources **112** is qualified and/or eligible to receive the work item and further determine which of the plurality of processing resources **112** is best suited to handle the processing needs of the work item. In situations of work item surplus, the work assignment engine **120** can also make the opposite determination (i.e., determine optimal assignment of a work item to a resource). In some embodiments, the work assignment engine **120** is configured to achieve true one-to-one matching by utilizing bitmaps/tables and other data structures.

In accordance with at least some embodiments of the present disclosure, the work assignment engine **120** may be configured to execute one or several executable strategies **124** to make work assignment decisions. As will be discussed in further detail herein, the work assignment engine **120** may comprise a plurality of executable strategies **124**, where one or more of the executable strategies **124** include one or many tasks that are performed by the work assignment engine **120** during execution of the executable strategy **124**. The order or manner in which the tasks of a strategy **124** are executed by the work assignment engine **120** may be defined by rules or policies, which may also be included in the executable strategy **124**.

The work assignment engine **120** and its various components may reside in the work assignment mechanism **116** or in a number of different servers or processing devices. In some embodiments, cloud-based computing architectures can be employed whereby one or more components of the work assignment mechanism **116** are made available in a cloud or network such that they can be shared resources among a plurality of different users.

FIG. **2** shows a diagram of communication system **200** in accordance with at least some embodiments of the present disclosure. In one embodiment, agent **202** is or will be engaged in a conversation with customer **206** via communication network **210**. As mentioned above, certain well-known components are omitted for purposes of avoiding unnecessary complications to the figure. Agent **202** is, one embodiment of resource **112** operable to receive work assignments from routing engine **132** and work assignment mechanism **116**. The work assignments may require agent **202** to place or receive a call. Agent **202**, utilizing communication device **204**, is or will be engaged in a conversation with customer **206** utilizing customer device **208** which may be a voice call and/or a video call with a voice portion. Agent device **204** and/or customer device **208** may be one or more of POTS telephone, SIP endpoint, VoIP telephone, cellular telephone, video display/capture device, and/or other communication device operable to accommodate, at least, voice communication from agent **202**. Similarly, communication network **210** may comprise one or more of cellular network, wired data network, wireless data network, public switched telephone network, satellite links, Internet, and/or other communication conduit operable to enable agent **202** utilizing agent device **204** to communicate with customer **206** using customer device **208**.

Communication network **210** comprises various components (not shown for clarity). Despite the great speeds in which the various components may operate, communication network **210** inevitably comprises processing delay **212** and transmission delay **214**. For clarity, only one of each type of delay is shown—in general there may be multiple delays of each type occurring in any order. In one embodiment, processing delay **212** represents signal processing equipment, such as that maintained by a contact center to enable agent device **204** to connect to networks outside of the contact center. For example, codecs to convert analog signals into packets for transport on digital networks, such as the Internet, is one example of processing delay **212**. In another embodiment, transmission delay **214** comprises the delay introduced by distance and/or systems on communication network **210**, which is generally outside of the control of a contact center (e.g., telephone company central office hardware and software). As mentioned, distance may be a significant portion of transmission delay **214**. If agent **202** and customer **206** are on opposite sides of the Earth, even signals traveling at the speed of light introduce a delay that is readily perceived by human participants. As a result, real-time communication generally has at least some delay. The total delay may range from unperceivable, to noticeable, and on to significant and disruptive. As a benefit of certain embodiments disclosed herein, agent **202** may be provided

with a cue to overtalk customer **206** by an amount determined to provide customer **206** with a more natural conversational experience.

In one embodiment, overtalk system **216** determines specific values of processing delay **212** and/or transmission delay **214** and provides a cue, such as via agent display **220**, to agent **202** on the degree of overtalk desired for a particular customer **206**. As the components causing processing delay **212** are generally accessible to a particular contact center, processing delay **212** may be determined by direct observation. Utilization of known or estimated values of components may also be utilized (e.g., published specifications for a particular component). Processing delay **212** may be substantially static and vary, or be suspected of varying, only upon the installation and/or removal of components and processes of a contact center. Certain variations may occur, such as during times of high contact center utilization, processing delay **212** may be greater than at times of low contact center utilization. Accordingly, processing delay **212** may be determined on a call-by-call basis, periodic basis, or one-time basis in accord with the variability of the processing delay.

In another embodiment, transmission delay **214** may be determined on a call-by-call basis to account for, in part, the geographic distance between customer **206** and agent **202**. Delays introduced by known or suspected hardware and/or software may also be utilized. Transmission delay **214** may be generalized such that determining transmission delay **214** may occur less frequently than a call-by-call basis. For example, all customers (e.g., a plurality of customer **206**) within a particular region may be associated with the same transmission delay **214**. Similarly, calls to the cellular telephone of customers may be subject to an additional delay specific to all cellular calls or calls known to utilize a particular cellular network or technology may have a known or determined increment to the transmission delay based on land-line communications. Transmission delay **214** may vary based, at least in part, on the time of day, week, holiday, disaster, or other one-time or periodic events.

In another embodiment, overtalk analysis engine **218** determines an overtalk amount comprised of processing delay **212** and/or transmission delay **214**. In addition to the mathematical operation to determine the overtalk amount, certain key words or phrases spoken by customer **206** may be indicative of too much or too little overtalk. For example, if customer **206** routinely repeats the first sound or syllable (e.g., "I . . . I have another question") that may be an indication that they are hearing agent **202** at a time when they believe it is their turn to speak and overtalk analysis engine **218** may decrease the value of the overtalk amount accordingly. In another example, if customer **206** says words, phrases, or what is believed or known to be a partial word or phrase associated with determining if agent **202** is still engaged in the call (e.g., "H," "Hello?" "Are," "Are you . . . ," etc.), overtalk analysis engine may then increase the overtalk amount.

In another embodiment, overtalk analysis engine **218** accesses at least one record within cultural norms database **226**. For example, if customer **206** is known or suspected to be Japanese, where more delay between speakers is a sign of respect and politeness, then overtalk analysis engine **218** accesses a record within cultural norms database **226** associated with Japan and/or Japanese natives to retrieve a corresponding cultural delay. As a result, overtalk analysis engine **216** may consider processing delay **212**, transmission delay **214**, and/or a cultural delay to determine an overtalk amount. The cultural delay may be result in an increase, decrease, or no chance in the overtalk amount, as compared to the delay determined from processing delay **212** and/or transmission delay **214**. For example if the overtalk amount, based on processing delay **212** and transmission delay **214**, is 0.5 seconds, but the cultural norm for customer **206** indicates that 0.5 seconds is appropriate, then the net overtalk amount would be zero.

In another embodiment, overtalk analysis engine **218** causes an indicator to display on agent terminal **220** indicating the overtalk amount and/or their current overtalk amount. This aspect of the disclosure will be discussed more completely with respect to FIG. **3**.

The performance of agent **202** may be analyzed in real time or at a later time. If agent **202** is engaged in a call with non-trivial delays, a recording of such a call made substantially from the perspective of agent **202**, may incorrectly indicate agent **202** is interrupting or talking over customer **206**. Accordingly, in another embodiment, a delay is inserted agent's **202** channel to simulate the conversation from the perspective of customer **206**. Overtalk analysis engine **218** may insert or cause the insertion of such a delay such that call recordings database **222** records the call from the simulated perspective of customer **206**. Alternatively, the delay may be inserted during, or prior to, playback of a recording. As a result, call analytics engine **224** which may be a human and/or automated examination of a prior call, may be presented with and analyze the call from the perspective of customer **206**. Call analytics engine **224** may alternatively access a live feed of a call with the appropriate delay of the overtalk amount inserted therein.

FIG. **3** shows a portion of agent display **220** displaying dialog window **300** in accordance with at least some embodiments of the present disclosure. In one embodiment, dialog window **300** is operable to provide a visual display of at least a target overtalk indicator to agent **202**. It should be appreciated that dialog window **300** represents one means to provide visual information to agent **202** and that embodiments providing audio or tactile cues may also be implemented without departing from the teachings herein.

In one embodiment, dialog window **300** includes text status **302**, such as to instruct agent **202** to apply more overtalk. In another embodiment, thermometer-style display **304** provides a more detailed display of the current and target overtalk amount. Showing a current graphical overtalk portion **306**, an unutilized graphical overtalk portion **310**, and discrepancy graphical overtalk portion **308**. It should be noted that other graphical, textual, audio, and/or tactile displays may be utilized without departing from the teachings herein. In another embodiment, current indicator **314** shows a current overtalk amount **314** (e.g., 0.4 seconds) and/or a target overtalk amount **312** (e.g., 0.6 seconds).

The determination of the current overtalk amount may be based on the last communication exchange or an average or other mathematical operation of a number of communication exchanges. An average overtalk may be determined for a particular conversation as one means of providing current indicator **314**. In another embodiment, outlier high or low observed overtalk values may be discarded, such as when agent **202** has a legitimate reason to interrupt customer **206** (e.g., "Are you sure it was on the 14^{th}?" (customer **206** begins speaking) "Found it. It was on the 17^{th}."). Accordingly, an unusually high degree of overtalk may be discarded from the current overtalk calculation. Similarly, longer pauses may be indicative of waiting for a system to retrieve information or perform an operation or for agent **202** to

ponder a particular issues and, therefore, unusually long periods of pausing may similarly be excluded from a current overtalk calculation.

FIG. **4** shows call analysis system **400** in accordance with at least some embodiments of the present disclosure. In one embodiment, overtalk analysis engine **218** determines an overtalk value and provides the overtalk value to call playback system **402** to be maintained as delay **404**. Communication from agent channel **406** is then buffered or otherwise delayed by delay **404** to simulate the call experience from the perspective of customer **206**. Customer channel **408** and/or agent channel **406** is then provided to call analytics engine **224** in real time or recorded by call recordings database **222** to be made available to call analytics engine **224** at a later time.

FIGS. **5**A and **5**B show a conversation segment between agent **202** and customer **206** without overtalk correction. Customer **206** speaks customer portions **502**, **506** and agent **202** speaks agent portions **504**, **508**. As illustrated with respect to FIG. **5**A, agent **202** hears customer **206** speak customer portion **502**, in its entirety, and then speaks agent portion **504**. Then, agent **202** is interrupted by customer **206** speaking customer portion **506**. From the perspective of agent **202**, customer portion **506** appears to come unexpectedly as agent **202** is currently speaking. Agent **202** then continues with agent portion **508**.

As illustrated with respect to FIG. **5**B, customer **206** speaks customer portion **502** and fails to receive a reply during silence **510**. Customer **206**, wondering if agent **202** is still there, then speaks **506**, however, as customer **206** is speaking, customer **206** hears agent portion **504**, and stops talking. Silence **512** follows and customer **206** may again be wondering if agent **202** is still on the call, however, by pausing slightly longer, customer **206** then hears agent portion **508**. The exchange illustrated by FIGS. **5**A and **5**B may be functional but without overtalk correction, silences **510**, **512** cause a clumsy and awkward exchange. Customer **206** may have an unsatisfactory experience and may even abandon the call.

FIGS. **6**A and **6**B show a conversation segment between agent **202** and customer **206** using overtalk correction in accordance with at least some embodiments of the present disclosure. As illustrated with respect to FIG. **6**A, customer **206** speaks customer portions **602**, **606** and agent **202** speaks agent portions **604**, **608**. Agent **202** is trained and/or prompted, such as by dialog window **300**, to overtalk customer **206**. Agent **202**, determining that customer portion **602** is about to end, begins speaking customer portion **604** with overtalk amount **610**. Agent **202** then experiences silence **612**, which should be expected by agent **202**. Agent **202** then hears customer portion **606** and begins speaking agent portion **208** with overtalk amount **614**.

As illustrated with respect to FIG. **6**B, the experience from the perspective of customer **206** is a more natural flow. Customer **206** speaks customer portion **602**, after a normal conversational delay hears agent portion **604**, responds with customer portion **606** and, after another normal conversational delay, hears agent portion **608**. In another embodiment, the normal conversational delay, may be a delay determined with respect to a cultural norm, as described more fully with respect to FIG. **2**.

FIG. **7** shows process **700** in accordance with at least some embodiments of the present disclosure. In one embodiment, a processor, such as or controlled by or integral to overtalk analysis engine **218**, determines a transmission delay value for a current or prospective call between agent **202** and customer **206**. Step **702** may be calculated or, for at least one portion of the transmission delay, may be a retrieved stored value, such as a typical delay encountered with the same customer **206** or with other customers within a similar geographic area as customer **206**.

Step **704** accesses a processing delay for the call. Step **704** may access a stored value, such as when equipment associated with supporting the call has not changed and is the embodying system has a processing delay that is substantially static. However, in other embodiments, step **704** may determine the processing delay on a call-by-call basis or for a number of calls or other periodic basis. For example, all voice-only calls to customers may have one delay, however, all video calls may have an additional delay representing video encoding/decoding and other additional processes. Similarly, calls utilizing POTS may have one processing delay whereas VoIP calls may have another processing delay. Step **704** may determine a single value for all processing delays for a current or prospective call.

Optionally, step **706** may determine a cultural norm delay. This reflects an assumed customer characteristic that customer **206** may prefer to have a certain length of a pause between speakers of a conversation. As a result, the overtalk amount produced by step **708** may be increased or decreased such that the end result is an appropriate cultural norm delay for the particular customer **206**. Step **710** then presents the target overtalk amount to agent **202** to prompt agent **202** to overtalk customer **206** the target value.

In the foregoing description, for the purposes of illustration, methods were described in a particular order. It should be appreciated that in alternate embodiments, the methods may be performed in a different order than that described. It should also be appreciated that the methods described above may be performed by hardware components or may be embodied in sequences of machine-executable instructions, which may be used to cause a machine, such as a general-purpose or special-purpose processor (GPU or CPU) or logic circuits programmed with the instructions to perform the methods (FPGA). These machine-executable instructions may be stored on one or more machine readable mediums, such as CD-ROMs or other type of optical disks, floppy diskettes, ROMs, RAMs, EPROMs, EEPROMs, magnetic or optical cards, flash memory, or other types of machine-readable mediums suitable for storing electronic instructions. Alternatively, the methods may be performed by a combination of hardware and software.

Specific details were given in the description to provide a thorough understanding of the embodiments. However, it will be understood by one of ordinary skill in the art that the embodiments may be practiced without these specific details. For example, circuits may be shown in block diagrams in order not to obscure the embodiments in unnecessary detail. In other instances, well-known circuits, processes, algorithms, structures, and techniques may be shown without unnecessary detail in order to avoid obscuring the embodiments.

Also, it is noted that the embodiments were described as a process which is depicted as a flowchart, a flow diagram, a data flow diagram, a structure diagram, or a block diagram. Although a flowchart may describe the operations as a sequential process, many of the operations can be performed in parallel or concurrently. In addition, the order of the operations may be re-arranged. A process is terminated when its operations are completed, but could have additional steps not included in the figure. A process may correspond to a method, a function, a procedure, a subroutine, a subprogram, etc. When a process corresponds to a function, its termina-

tion corresponds to a return of the function to the calling function or the main function.

Furthermore, embodiments may be implemented by hardware, software, firmware, middleware, microcode, hardware description languages, or any combination thereof. When implemented in software, firmware, middleware or microcode, the program code or code segments to perform the necessary tasks may be stored in a machine readable medium such as storage medium. A processor(s) may perform the necessary tasks. A code segment may represent a procedure, a function, a subprogram, a program, a routine, a subroutine, a module, a software package, a class, or any combination of instructions, data structures, or program statements. A code segment may be coupled to another code segment or a hardware circuit by passing and/or receiving information, data, arguments, parameters, or memory contents. Information, arguments, parameters, data, etc. may be passed, forwarded, or transmitted via any suitable means including memory sharing, message passing, token passing, network transmission, etc.

While illustrative embodiments of the disclosure have been described in detail herein, it is to be understood that the inventive concepts may be otherwise variously embodied and employed, and that the appended claims are intended to be construed to include such variations, except as limited by the prior art.

What is claimed is:

1. A method for determining communication delays in a contact center, comprising:

measuring, by a processor, a transmission delay value indicating the transmission delay of a voice portion of a conversation between an agent communication device and a customer communication device;

measuring, by the processor, a processing delay value indicating the processing delay of the voice portion of the conversation;

determining, by the processor, an overtalk indicator based on the transmission delay value and the processing delay value; and

providing, by the processor, the overtalk indicator to one of the agent communication device or a call analytics engine.

2. The method of claim **1**, wherein the overtalk indicator indicates an overtalk amount and wherein the overtalk amount is the sum of the transmission and processing delay values.

3. The method of claim **2**, wherein determining the overtalk indicator further comprises the processor adding to the overtalk amount a third delay value, the third delay value indicating a cultural norm for conversational delay.

4. The method of claim **2**, further comprising:

inserting, by the processor, a simulated delay of the overtalk amount into the agent communication device portion of the conversation; and

providing, by the processor, a recording of the conversation, with the simulated delay, to a recording device.

5. The method of claim **4**, further comprising:

recording, by the processor, the conversation from a perspective substantially equivalent to the agent communication device's perspective; and

wherein the processor inserts the simulated delay into the recording during providing the recording.

6. The method of claim **1**, wherein measuring the transmission delay value further comprises the processor transmitting one of a ping or a traceroute and determining the measured transmission delay by using the one of the ping or the traceroute.

7. The method of claim **2**, wherein the processor determines the overtalk amount by calculating the overtalk amount in accord with a spoken indicator associated with the overtalk amount being too much or too little.

8. The method of claim **2**, wherein the processor determines the overtalk amount by calculating the overtalk amount in accord with a delay associated with a prior call.

9. The method of claim **2**, wherein the processor determines the overtalk amount by calculating the overtalk amount to include an estimated transmission delay.

10. The method of claim **2**, wherein the processor determines the overtalk amount by calculating the overtalk amount to include an estimated number of transmission components and the delay associated therewith.

11. The method of claim **2**, wherein the processor determines the overtalk amount by calculating the overtalk amount to include a geographic distance between the agent communication and the customer communication device.

12. A contact center, comprising:

a processor;

a network interface that facilitates communication between an agent device and a customer device; and

wherein the processor is programmed to:

measure a transmission delay value indicating the transmission delay of a voice portion of a conversation between the agent communication device and the customer communication device;

measure a processing delay value indicating the processing delay of the voice portion of the conversation;

determine an overtalk indicator based on the transmission delay value and the processing delay value; and

provide the overtalk indicator to one of the agent communication device or a call analytics engine.

13. The contact center of claim **12**, wherein the overtalk indicator indicates an overtalk amount and wherein the overtalk amount is the sum of the transmission and processing delay values and further comprising:

a database having stored therein a third delay value, the third delay value indicating a cultural norm for conversational delay; and

wherein the processor calculates the overtalk amount by adding the third delay value to the overtalk amount.

14. The contact center of claim **13**, wherein the processor is further programmed to:

insert a simulated delay of the overtalk amount into the agent communication device's portion of the conversation; and

provide a recording of the conversation, with the simulated delay, to a call analyzer.

15. The contact center of claim **14**, wherein the processor is further programmed to:

record the conversation from a perspective substantially equivalent to the agent communication device's perspective; and

wherein the processor inserts the simulated delay into the recording during the providing of the recording.

16. The contact center of claim **13**, wherein the processor is programmed to determine the overtalk amount by calculating the overtalk amount in accord with a spoken indicator associated with the overtalk amount being too much or too little.

17. The contact center of claim **13**, wherein the processor is programmed to determine the overtalk amount by calculating the overtalk amount in accord with a delay associated with a prior call.

18. The contact center of claim 13, wherein the processor is programmed to determine the overtalk amount by calculating the overtalk amount to include an estimated transmission delay.

19. The contact center of claim 13, wherein the processor is programmed to determine the overtalk amount by calculating the overtalk amount to include an estimated number of transmission components and the delay associated therewith.

20. The contact center of claim 13, wherein the processor is programmed to determine the overtalk amount by calculating the overtalk amount to include a geographic distance between the agent communication device and the customer device.

21. A contact center, comprising:

a processor;

a network interface operable to facilitate communication between an agent device and a customer device; and

wherein the processor is programmed to:

measure a transmission delay value indicating the transmission delay of a voice portion of a conversation between the agent communication device and the customer communication device;

measure a processing delay value indicating the processing delay of the voice portion of the conversation;

determine an overtalk indicator based on the transmission delay value and the processing delay value, wherein the overtalk indicator indicates an overtalk amount and wherein the overtalk amount is the sum of the transmission and processing delay values; and

provide the overtalk indicator to one of the agent communication device or a call analytics engine.

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